

and another area of low pressure on the south Atlantic coast; on the 28th with an area of low pressure central over New

England; and on the 29th with an area of low pressure central southeast of Nova Scotia.

TEMPERATURE OF THE AIR (expressed in degrees, Fahrenheit).

The distribution of mean temperature over the United States and Canada for October, 1889, is exhibited on chart ii by dotted isotherms. In the table of miscellaneous meteorological data the monthly mean temperature and the departure from the normal are given for regular stations of the Signal Service. The figures opposite the names of the geographical districts in the columns for mean temperature and departure from the normal show, respectively, the averages for the several districts. The normal for any district may be found by adding the departure to the current mean when the departure is below the normal and subtracting when above. The monthly mean temperature for regular stations of the Signal Service represents the mean of the maximum and minimum temperatures.

In October, 1889, the mean temperature was highest in extreme southeastern California and southwestern Arizona, the lower Rio Grande valley, and extreme southern Florida, where it was above 75°, the highest mean reading, 84°·5, being reported at Fort Brown, Tex. The mean values were above 65° south of a line traced irregularly westward from the Georgia coast to southeastern Arizona, thence northwestward over the San Joaquin Valley, and thence east of south to the California coast near Los Angeles. The lowest mean temperature was reported north of a line traced from Manitoba east-southeast to west-central Quebec, and in central Colorado, where it fell below 35°, the lowest means reported being 28°·8, at Dolly Varden Mines, Colo., and 33°·2, at Atlantic, Mich. The mean readings were generally below 50° north of a line traced from the southern coast of New England southwestward to western Virginia, thence northwestward to central Dakota, thence west-southwest to south-central New Mexico, and thence irregularly northwestward to Puget Sound, over western portions of the middle plateau region, and in south-central Oregon.

The reports of regular stations of the Signal Service show that the mean temperature for October, 1889, was below the normal east of the Rocky Mountains, except in Dakota, in Texas west of the ninety-eighth meridian, and at coast stations in New Brunswick and southeastern Nova Scotia. In the Rocky Mountain and plateau regions and on the Pacific coast the month was warmer than the average October. The greatest departures below the normal temperature occurred from the middle Atlantic and North Carolina coasts northward over the Lake region, where they exceeded 5°, and the most marked departures above the normal were noted in the northern plateau region and on the northeastern slope of the Rocky Mountains, where they were more than 5°. Considered by districts the average departure below the normal temperature was 6°·3 in the lower lake region; 5°·3 in the middle Atlantic states; 4°·9 in the Ohio Valley and Tennessee; 4°·6 in the upper lake region; 4°·0 in the south Atlantic states and the upper Mississippi valley; 3°·3 in New England; 3°·2 in the Florida Peninsula and the east Gulf states; 1°·4 in the west Gulf states; and 0°·4 in the Missouri Valley. The average departure above the normal temperature was 6°·1 in the northern plateau region; 4°·4 on the northeastern slope of the Rocky Mountains; 3°·4 on the south Pacific coast; 3°·3 on the north Pacific coast; 2°·4 in the extreme northwest and the middle plateau region; 1°·8 in the southern plateau region; 0°·8 on the southeastern slope of the Rocky Mountains; and 0°·6 on the middle Pacific coast. On the middle-eastern slope of the Rocky Mountains and in the Rio Grande Valley the mean temperature averaged normal.

The following are some of the most marked departures from the normal at the older established Signal Service stations:

Above normal.		Below normal.	
Fort Maginnis, Mont.	7·2	Erie, Pa.	7·8
Medicine Hat, N. W. T.	7·0	Rochester, N. Y.	7·1
Spokane Falls, Wash.	6·4	Cape Henry, Va.	6·6
Portland, Oregon	4·2	Cincinnati, Ohio	6·4
San Diego, Cal.	3·4	Saugeen, Ont.	6·0

DEVIATIONS FROM NORMAL TEMPERATURES.

The following table shows for certain stations, as reported by voluntary observers, (1) the normal temperature for a series of years; (2) the length of record during which the observations have been taken, and from which the normal has been computed; (3) the mean temperature for October, 1889; (4) the departure of the current month from the normal; (5) the extreme monthly means for October, during the period of observation and the years of occurrence:

State and station.	County.	(1) Normal for the month of Oct.	(2) Length of record.	(3) Mean for Oct., 1889.	(4) Departure from normal.	(5) Extreme monthly mean temperature for Oct.			
						Highest.	Year.	Lowest.	Year.
Arkansas.		°	Years	°	°	°		°	
Lead Hill	Boone	60·2	8	59·2	-1·0	64·0	1881	56·0	1885
California.									
Sacramento	Sacramento	61·9	36	55·6	-6·3	69·9	1875	54·8	1886
Colorado.									
Fort Lyon	Bent	58·0	19	53·8	-4·2	57·8	1871	42·2	1867
Connecticut.									
Middletown	Middlesex	50·1	22	47·2	-2·9	54·7	1871	45·5	1888
Florida.									
Merritt's Island	Brevard	74·9	5	73·8	-1·1	76·2	1884	73·1	1885
Georgia.									
Forsyth	Monroe	67·4	15	65·7	-1·7	75·4	1884	61·7	1885
Illinois.									
Peoria	Peoria	54·0	30	50·2	-3·8	62·7	1879	45·2	1869
Riley	McHenry	47·5	33	45·7	-1·8	56·0	1879	38·6	1869
Indiana.									
Vevay	Switzerland	56·1	23	51·6	-4·5	65·0	1879	43·2	1869
Iowa.									
Cresco	Howard	46·0	17	43·0	-3·0	54·1	1879	41·2	1873
Monticello	Jones	49·1	34	44·7	-4·4	58·0	1879	36·0	1873
Logan	Harrison	52·6	15	52·3	-0·3	60·7	1879	48·5	1875
Kansas.									
Lawrence	Douglas	54·4	21	53·6	-0·8	60·5	1879	44·0	1869
Wellington	Sumner	56·6	10	.....	.....	60·6	1879, '84	53·3	1880, '83
Louisiana.									
Grand Coteau	Saint Landry	68·8	8	67·6	-1·2	75·5	1883	64·8	1885
Maine.									
Gardiner	Kennebec	47·2	49	.....	.....	52·4	1879	43·1	1859
Maryland.									
Cumberland	Allegany	50·8	30	49·5	-1·3	60·0	1881	41·8	1869
Massachusetts.									
Amherst	Hampshire	48·8	53	48·2	-0·6	56·0	1879	42·8	1841
Newburyport	Essex	49·6	11	46·9	-2·7	55·0	1879	45·1	1888
Somerset	Bristol	52·6	17	50·9	-1·7	58·1	1879	47·6	1874
Michigan.									
Kalamazoo	Kalamazoo	50·7	13	46·8	-3·2	54·5	1879	45·7	1887
Thornville	Lapeer	50·8	12	45·6	-5·2	58·5	1879	45·6	1889
Minnesota.									
Minneapolis	Hennepin	45·4	24	43·8	-1·6	56·1	1879	36·5	1869
Montana.									
Fort Shaw	Lewis & Clarke	48·9	20	51·2	+2·3	58·1	1879	34·6	1881
New Hampshire.									
Hanover	Grafton	44·9	54	42·4	-2·5	52·4	1879	38·6	1836
New Jersey.									
Moorestown	Burlington	53·5	26	49·8	-3·7	59·5	1879	48·6	1888
South Orange	Essex	53·0	19	48·4	-4·6	58·1	1879	47·2	1871
New York.									
Cooperstown	Otsego	46·5	35	41·6	-4·9	53·3	1879	40·7	1865
Palermo	Oswego	47·2	35	41·8	-5·4	53·9	1879	41·8	1889
North Carolina.									
Lenoir	Caldwell	56·8	18	54·0	-2·8	66·4	1878	48·0	1874
Ohio.									
N'th Lewisburgh	Champaign	52·0	57	48·6	-3·4	58·0	1852	43·0	1869
Wauseon	Fulton	50·7	19	45·2	-5·5	59·0	1879	45·2	1889
Oregon.									
Albany	Linn	51·9	9	54·4	+2·5	56·3	1885	48·7	1881
Eola	Polk	51·4	18	54·9	+3·5	59·7	1876	45·4	1873
Pennsylvania.									
Dyberry	Wayne	46·7	21	41·6	-5·1	53·4	1879	41·2	1869
Grampian Hills	Clearfield	47·8	25	45·1	-2·7	56·4	1879	39·2	1869
South Carolina.									
Statesburgh	Sumter	64·0	8	60·4	-3·6	69·0	1881	59·8	1885, '88

Deviations from normal temperatures—Continued.

State and station.	County.	(1) Normal for the month of Oct.	(2) Length of record.	(3) Mean for Oct., 1889.	(4) Departure from normal.	(5) Extreme monthly mean temperature for Oct.			
						Highest.	Year.	Lowest.	Year.
<i>Tennessee.</i>									
Austin	Wilson	59.6	20	56.7	-2.9	70.2	1879	52.5	1888
Milan	Gibson	56.2	6	56.0	-0.2	62.4	1883	50.5	1884
<i>Texas.</i>									
New Ulin	Austin	69.6	16	70.5	+0.9	73.9	1881	65.8	1873
<i>Vermont.</i>									
Strafford	Orange	47.0	16	43.6	-3.4	52.8	1879	40.6	1888
<i>Virginia.</i>									
Birdsnest	Northampt'n	61.2	21	56.6	-4.6	69.2	1881	54.5	1869
Wytheville	Wythe	50.4	24			59.0	1879	46.3	1888
<i>Wisconsin.</i>									
Madison	Dane	48.0	20	46.2	-1.8	59.4	1864	39.8	1869
<i>Washington.</i>									
Fort Townsend ..	Jefferson	50.5	13	52.5	+2.0	54.6	1875	48.6	1879

The above table shows that at Thorntown, Mich., twelve years record, the mean temperature for the current month, 45° 6, was 0° 2 lower than previously reported for October; the lowest previous mean reading for this month being 45° 8, in 1887. At Palermo, N. Y., thirty-five years record, the mean, 41° 8, was 0.1 below the lowest October mean of preceding years, noted in 1887; and at Wauseon, Ohio, nineteen years record, the lowest previous mean for October, 46° 0, noted in 1875 and 1888, was 0° 8 higher than the mean for the current month. Unusually high mean temperatures are not shown by this table.

MAXIMUM AND MINIMUM TEMPERATURES.

The highest temperature reported at regular stations of the Signal Service was noted in Arizona, where it rose to 106° at Forts McDowell and Yuma. The maximum readings were 90° or above from southwestern Arizona northwestward over the valleys of the San Joaquin and Sacramento rivers, from the Rio Grande Valley northward to central Kansas, in extreme southern Louisiana, and at Jacksonville, Fla. The reports of United States Army post surgeons and state weather service and voluntary observers show maximum temperature of 100°, or above, as follows: Casa Grande, Ariz., 109°; Fort Lowell and Signal, Ariz., 101°; Fort Mojave, Ariz., 107°; Gila Bend, Ariz., 104°; New River and Phoenix, Ariz., 100°; Texas Hill, Ariz., 110°; Athlone and Delano, Cal., 101°; Cactus, Cal., 115°; Colton, Cal., 102°; Elmira, Goshen, and Needles, Cal., 100°; Fresno, Cal., 106°; Indio, Cal., 118°; Mammoth Tank, Cal., 108°; Mojave, Cal., 116°; Salton, Cal., 109°; Sanger Junction and Tulare, Cal., 102°; Seven Palms, Cal., 110°; Volcano Springs, Cal., 113°; Magnolia, Colo., 100°; Cameron, La., 100°; and San Antonio, Tex., 100°. The following are unusually high temperatures noted at regular stations of the Signal Service for October of previous years: 89° at Boston, Mass., in 1881; 92° at Washington, D. C., in 1879; 104° at Rio Grande City, Tex., in 1877; 94° at Knoxville, Tenn., in 1884; 87° at Rochester, N. Y., Cleveland, Ohio, and Marquette, Mich., 95° at Fort Buford, Dak., and 90° at Saint Louis, Mo., in 1879; 90° at Topeka, Kans., and Oret, Nebr., in 1887; 89° at North Platte, Nebr., in 1879; 92° at Concordia, Kans., in 1887; 93° at Abilene, Tex., in 1885; 108° at Yuma, Ariz., in 1887; 93° at Ashland, Oregon, in 1885; and 102° at Los Angeles, Cal., in 1885. At the following-named stations of the Signal Service the maximum temperature was as high or higher than previously reported for October: New Orleans, La., nineteen years record, 90°, the same as maximum of 1884; Fort Assiniboine, Mont., ten years record, 89°, 6° above maximum of 1884 and 1885; Fort Custer, Mont., eleven years record, 89°, 2° above maximum of 1879; Fort Maginnis, Mont., eight years record, 87°, 4° above maximum of 1885; Helena, Mont., ten years record, 80°, 3° above maximum of 1885; Dodge City, Kans., sixteen years record, 94°, 2° above maximum of 1887; Fort Reno, Ind. T., seven years record, 91°, 3° above maximum of 1884; Fort Supply, Ind. T., seven years

record, 96°, 6° above maximum of 1887; Fort Elliott, Tex., ten years record, 94°, 5° above maximum of 1887; Fort Sill, Ind. T., twelve years record, 94°, 3° above maximum of 1878 and 1884; Fort Apache, Ariz., eleven years record, 88°, the same as maximum of 1887; Fort McDowell, Ariz., six years record, 106°, 2° above maximum of 1885; Fort Verde, Ariz., thirteen years record, 96°, the same as maximum of 1887; Whipple Barracks (Prescott), Ariz., fourteen years record, 87°, 1° above maximum of 1881; Keeler, Cal., five years record, 91°, the same as maximum of 1887; Winnemucca, Nev., eleven years record, 87°, the same as maximum of 1887; Salt Lake City, Utah, sixteen years record, 86°, 1° above maximum of 1887; Montrose, Colo., five years record, 83°, the same as maximum of 1887; Boise City, Idaho, thirteen years record, 91°, 4° above maximum of 1887; Spokane Falls, Wash., nine years record, 86°, 4° 5 above maximum of 1888; Olympia, Wash., twelve years record, 74°, the same as maximum of 1888; Tatoosh Island, Wash., seven years record, 65°, 1° 5 above maximum of 1883; Port Angeles, Wash., six years record, 64°, the same as maximum of 1885; San Francisco, Cal., nineteen years record, 87°, the same as maximum of 1887. The highest temperatures for October have been generally noted in New England and the middle Atlantic states in 1879 or 1884; in the south Atlantic, east and west Gulf states, and in the Ohio Valley and Tennessee in 1884; in the Rio Grande Valley in 1877; in the lower lake region in 1872 or 1879; in the middle-eastern and northeastern slope of the Rocky Mountains and the middle and northern plateau regions in 1889; on the north Pacific coast in 1885; and on the middle Pacific coast in 1887. In districts other than those named the periods were irregular.

In October, 1889, the maximum temperature was lowest in northeastern New England, and at stations in northern Michigan, where it fell below 60°, and the maximum readings were below 70° over northern New England, along the southern coast of New England, in northern and western New York, a greater part of Michigan, northern Wisconsin, and on the extreme north Pacific coast.

The lowest temperature reported by a regular station of the Signal Service was 9°, at Saint Vincent, Minn.; at Northfield, Vt., a reading of 12° was registered. The temperature fell below 30° north of a line traced from the Massachusetts coast southwestward to central Tennessee, thence northward to southeastern Wisconsin, thence west-southwest to east-central Arizona, thence northwestward to west-central Oregon, thence southeast to northern Utah, and thence northward over Montana to the British Possessions; at Fort Klamath, Oregon, a reading of 20° was reported. The highest minimum temperature was noted over southern Florida where it was above 65°, and the lowest temperature values were above 50° over the southern half of Florida, on the west Gulf coast, and on the Pacific coast south of San Francisco, Cal. The following are the lowest readings reported in the several states and territories where temperature of 32° or below was reported, as shown by reports of United States Army post surgeons and state weather service and voluntary observers: 27° at Double Springs, Ala.; 20° at Williams, Ariz., and Devall's Bluff, Ark.; 22° at Boca, Cal.; zero at Dolly Varden Mines, Colo.; -9° at Pike's Peak, Colo.; 18° at New Hartford, Conn.; 12° at New England City, Dak.; 32° at Kirkwood, Del.; 25° at Duck, Ga.; 5° at Soda Springs, Idaho; 18° at Mount Morris, Ill.; 17° at Richmond, Ind.; 30° at Fort Gibson, Ind. T.; 12° at Wesley, Iowa; 20° at Fremont, Kans.; 23° at Ashland, Ky.; 31° at Plaquemine, La.; 13° at Mayfield, Me.; 24° at Cumberland, Md.; 16° at Monson and Gilbertville, Mass.; 8° at Roscommon, Mich.; 28° at Corinth, Miss.; 23° at Steelville, Mo.; 11° at Camp Poplar River, Mont.; 11° at Ansley, Nebr.; 21° at Carson City, Nev.; 6° at Berlin Falls, N. H.; 23° at Hanover, N. J.; 17° at Coolidge, N. Mex.; 12° at Angelica and Saranac Lake, N. Y.; 20° at Franklin, and 26° at Hot Springs, N. O.; 16° at Garrettsville, Lordstown, and Orangeville, Ohio; 20° at Jordan Valley, Oregon; 10° at Meadville, Pa.; 27° at Woonsocket, R. I.; 22° at Spartan-

burgh, S. C.; 26° at Hohenwald, Nunnally, and Riddleton, Tenn.; 24° at Hartley, Tex.; 22° at Beaver, Utah; zero at Weatherford Centre, Vt.; 26° at Lexington, Va.; 22° at Seven Pines, W. Va.; 11° at Wausau, Wis., and Camp Pilot Butte, Wyo. At the following named Signal Service stations the temperature was as low or lower than previously reported for October: Portland, Me., eighteen years record, 26°, 2° below minimum of 1886; Fort Smith, Ark., eight years record, 31°, the same as minimum of 1886; Brownsville, Tex., fourteen years record, 49°, the same as minimum of 1879; Oswego, N. Y., nineteen years record, 24°, the same as minimum of 1887; Lava, N. Mex., five years record, 28°, the same as minimum of 1888; Fort McDowell, Ariz., six years record, 38°, the same as minimum of 1886. The lowest temperature previously reported for October was generally noted in the east Gulf states, Ohio Valley and Tennessee, upper and lower lake regions, upper Mississippi and Missouri valleys, extreme northwest, southeastern slope of the Rocky Mountains, and northern plateau region in 1887, in the southern plateau region in 1880, and on the middle Pacific coast in 1881. In districts other than those named the periods of occurrence were irregular.

LIMITS OF FREEZING WEATHER.

The southern and western limits of freezing weather are shown on chart iv by a line traced from the south coast of New England southwestward to central Tennessee, thence northwestward to south-central Illinois, thence west-southwest to extreme southwestern New Mexico, thence northwestward to west-central Oregon, whence it curves eastward over the valley of the Columbia River, and thence northwestward to Puget Sound.

RANGES OF TEMPERATURE.

The greatest and least daily ranges of temperature at regular stations of the Signal Service are given in the table of miscellaneous meteorological data. The greatest monthly ranges occurred from Indian Territory northward over the Valley of the Red River of the North, in the upper Missouri valley, and over portions of the middle and southern plateau region, where they were more than 60°, whence they decreased eastward to less than 30° on the New England coast, southeastward to less than 30° on the Gulf coast, southwestward to less than 30° on the extreme south Pacific coast, and westward to 20° on the extreme north Pacific coast.

The following are some of the extreme monthly ranges:

Greatest,		Least.	
Fort Buford, Dak	74.0	Tatoosh Island, Wash	20.0
Dodge City, Kans	66.0	Key West, Fla.	21.0
Taylor's Ranch, Utah	65.0	Nantucket, Mass	27.0
Fort Assiniboine, Mont.	68.0	San Diego, Cal	28.0
Saint Vincent, Minn	68.0	Galveston, Tex	29.0

FROST.

Heavy frost, damaging vegetation, was reported as far south as University, Miss., Raleigh, Mount Pleasant, and Monroe, N. C., and Statesburgh, S. C. on the 8th, and at Ashwood, Tenn., and Double Springs, Ala., on the 31st. Light frost was reported in extreme south-central Georgia on the 8th, 9th, and 15th; in extreme southern Alabama and Mississippi on the 8th; in extreme southern Louisiana on the 27th and 28th; in central Texas as far south as the thirtieth parallel

on the 27th; in New Mexico as far south as Fort Stanton on the 18th and 23d, and Lava on the 30th; in Arizona as far south as Tucson on the 30th and 31st; in California as far south as Jolon on the 9th, and Keeler on the 26th; at Roseburgh, Oregon, on the 15th; in extreme south-central Oregon on the 12th, 28th, and 31st; in western Oregon generally on the 15th; and in northwestern Washington on the 15th and 16th. The occurrence of killing frost in the south Atlantic states was about one week earlier, and in northern Mississippi about two weeks earlier than the average date of first killing frost in those regions, while in northern Alabama and Tennessee it was seasonable. Compared with September, 1889, the southern limit of frost for the current month has extended southward nearly ten degrees on the Atlantic coast; from three to ten degrees in the east Gulf states and the Mississippi Valley; about two degrees in central Texas; remained about the same in New Mexico; about two degrees in Arizona; and about five degrees on the Pacific coast.

For October, 1889, frost was reported south of the fortieth parallel, and in the Pacific coast states, as follows: it was reported in the greatest number of states and territories, twenty-three, on the 9th and 16th; in twenty on the 8th and 17th; in seventeen on the 15th, 28th, and 29th; in sixteen on the 7th; in from nine to fifteen, inclusive, on the 3d, 5th, 6th, 10th, 14th, 18th, 19th, 23d to 27th, inclusive, 30th and 31st; in eight on the 11th and 20th; in from two to seven, inclusive, on the 1st, 2d, 4th, 12th, 13th, 21st, and 22d. There were no dates for which frost was not reported in two or more states or territories south of the fortieth parallel or on the Pacific coast.

Frost was reported on the greatest number of dates, twenty-six, in Pennsylvania; on twenty-three in Illinois and Ohio; nineteen in Nevada and Tennessee; eighteen in Indiana and Missouri; seventeen in Utah and West Virginia; from ten to fifteen, inclusive, in Alabama, Arizona, Colorado, Georgia, Kansas, Kentucky, Maryland, New Mexico, North Carolina, South Carolina, and Virginia; nine in Louisiana and Mississippi; seven in New Jersey; and from two to six, inclusive, in Arkansas, California, Delaware, District of Columbia, Indian Territory, Texas, and Washington. There were no states or territories south of the fortieth parallel or on the Pacific coast, except Florida, in which frost was not reported on two or more dates.

TEMPERATURE OF WATER.

The following table shows the maximum, minimum, and mean water temperature as observed at the harbors of the several stations; the monthly range of water temperature; and the mean temperature of the air for October, 1889:

Stations.	Temperature at bottom.				Mean temperature of air at the station.
	Max.	Min.	Range.	Monthly mean.	
Boston, Mass	57.0	48.0	9.0	51.3	48.5
Canby, Fort, Wash	60.5	55.3	5.2	56.9	56.3
Cedar Keys, Fla	84.3	61.0	23.3	74.4	68.8
Charleston, S. C	76.9	64.0	12.9	69.9	64.7
Eastport, Me	52.2	48.7	3.5	50.5	45.8
Galveston, Tex	77.0	70.0	7.0	73.6	72.2
Key West, Fla	84.9	74.0	10.9	79.7	76.8
Nantucket, Mass	63.0	48.5	14.5	55.7	52.0
New York, N. Y.	61.9	45.8	16.1	53.9	52.0
Portland, Oregon	63.9	54.0	9.9	57.5	57.2

PRECIPITATION (expressed in inches and hundredths).

The distribution of precipitation over the United States and Canada for October, 1889, as determined from the reports of nearly 2,000 stations, is exhibited on chart iii. In the table of miscellaneous meteorological data the total precipitation and the departure from the normal are given for each Signal Service station. The figures opposite the names of the geograph-

ical districts in the columns for precipitation and departure from the normal show, respectively, the averages for the several districts. The normal for any district may be found by adding the departure to the current mean when the precipitation is below the normal and subtracting when above.

The heaviest rainfall of the month fell in north-central Cali-